An Advanced IOT based Multi Activity Agriculture Robotic Platform with Android Controlled Navigation

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Abstract: In an Indian population, agriculture has more demands for production of food is necessary for the human being. To grow crops influence agriculture field is essential process it is necessary to irrigate crop productions. The design proposal of our work is to implement a multipurpose wirelessly controlled mobile agricultural robot, which can perform multiples agriculture related activities, like sprinkling of water or pesticide or fertilizer, weed cutting along with monitoring. It may be used as spraying like liquid or it may water for soil irrigation or growing plants well use fertilizer or keep undamaged plants, we use pesticide for pest control. Here, we have designed and fabricated a moving platform that consists of a two-wheel drive moving vehicle like mechanism with electric drive motors and steering control mechanism. This agricultural robot is designed using a wide range of technologies for the advancement of agricultural automation. It is outfitted with a portable embedded microcontroller, Bluetooth communication systems. The hardware implementation of the system uses an Atmega328 microcontroller as the main controller unit. Navigation, sprinkling and weed cutting different types of activities and they are controlled through mechanism from an android Mobile Phone. This allows us to send control commands to actuators and to carryout various activities. The whole robot system works on power derived from rechargeable battery.

***Index terms*- Smart Phone, Robotic Vehicle, Control of Pesticides, Water Management, Drive motor control mechanism.**

I. INTRODUCTION

In the economic nation agriculture plays an important role in the field sector. Agriculture is one of the major sources of food Production and raw material. It is one of the daily bases of life for the human species. In India there is 70% of population depends upon the farming. For cultivation the crop in the field is needed number of farmers there are many issues in farming the crops in the agriculture. To solve these problems, we used IOT Based Smart android, agriculture has been modernizing the current agriculture has been developed in the country. Robots are just of an overall push toward precision agriculture the productivity and comfort because they can work 24 hours without rest, and perform some tasks even better than a human, more precisely and in less amount of time. The various tasks that human cannot work physically due to some limitations and Impairments problem in body function, work overload, vaccination, constant speed etc so we exchanged different task of the human in to robotics. The smart phone device is used more for a power in communication interaction of human and machine. Smart phones itself consider as peripheral and become computing device in their own rights and support different sequence activities in a community. Most of the other Mobiles, Android OS Operating System has gained remarkable outstanding popularity. To enhance the agriculture give up crops in environmental factor is not enough. Here, there in many more productivity factor that is affected to some other extent. The attacks factor may be an insects and pest, which has its own way has to control as a result of spraying the harvest through suitable insecticide and pesticide. The other problem is during the process of growing crops there are possibilities that the field may get attacked by animal creatures. This intern leads to growth retardation of crops. Thirdly last stage of harvesting; there will be the possible attack of thefts. Pesticides are used for preventing, destroying or mitigation. To keep agriculture and greenhouse to protect the plants from the pest, we use the most powerful process of spraying chemical pesticides. To beat the drawbacks of existing System; we've got developed associate economical system for dispensing pesticides in agricultural fields and greenhouses with advanced options. In order to overcome this problem and to get an accurate result, we go for microcontroller based robotic design. Robotic finds its usage is many of application for example it is used in many tasks involved in horticulture such as weed cutting, spraying. The farmer knows how to do the spraying operation by himself without engaging labors, thus increasing spraying efficient.

II. PROJECT DESCRIPTION

In this project work, an agriculture robotics is designed using wireless technologies for the progression of agriculture automation. This system consists of two independent units namely a remotely helpful for robotic Vehicle Unit, and an android Smartphone, used as Navigation control Unit. This system is built-up for the farmer to operate Robotic through Smartphone. The text commands are sent to the robotic vehicle unit, through the built-in Bluetooth feature of the Smartphone. The android app used to have the button press to send commands to carryout various agriculture tasks. Bluetooth is only appropriate communication protocol.

This agriculture robot is designed around Atmega328 microcontroller, which make the robotic platform to maneuver and operate from are remote place in farm. The smart control functionality is obtained by the embedded software which has been developed by the microcontroller. Customer or user could control the basic function like movement (forward, backward, left, right, and neutral) and sprinkling of water, fertilizer and pesticide. The farmer can send commands to move the robotic vehicle like mechanism in required direction and to perform sprinkler on/off operation. The command sent through Smartphone will enable module Bluetooth is used for robotic vehicle and feed to the microcontroller in that system. This command fed to the microcontroller for interpretation, displaying on LCD display and control the geared DC motors to navigate the vehicle movements and also to rotate the water jet arm left and right. The geared DC motors are driven an H-bridge driver circuit. To sense the moment of water jet arm to extreme left or right ends we use lever type limit switches and prevent any damage that would be caused to the mechanism. This complete system is powered by 12V rechargeable battery and the batteries are charged by the charger unit when plugged in to AC mains.

III. PROBLEM STATEMENT

Farmer are increasing under the pressure to feed more people in the human population is rising in day-by-day. The farm fields of farmers are located miles far away from his home. Sometimes he needs to go to his work field for numerous times in a day to start and prevent the irrigation water pumps. Availability of nonstop strength is a scarce in among the villages around India, Resulting several trips an afternoon to perform the pumps. Farmer can't come to the field usually and additionally they cannot shield the plants from unconditional rain. So we are designing a portable machine that is based on Internet of Things (IOT) that is related to many sensors where with assist of sensors we controlling the pesticide sprinkling, fertilizer sprinkling, water sprinkling and plaguing which enables greater to farmer.

IV. OBJECTIVE

The prime goal of this work is to improve hardware and software programming to inventing new design to develop the prototype model. The project has been developed for multipurpose activities in agriculture production, android controlled, two wheeled agriculture robot, which able to response through commands sent by pressing button on the Bluetooth communication set of instruction followed by robot control mechanism. We use smart phone application which can be control moveable robot via Bluetooth.

V. SCOPE

The aim of the system is to develop a multi-tasking wirelessly controlled mobile agriculture robot mechanism. Beyond the valuable food, there is the overall pressure to make farming greener by using less water and pesticides. This can also make the agriculture as a zero loss of business.

VI. LITERATURE SURVEY

In [1] Elsevier was founded in 1880 was introduced modern publishing business. He has been published an article as a Multiple, redundant or concurrent publication. Use uniform lettering and sizing of your original artwork. Most popular product is management software products. It is supporting Citation style language styles such as Mendeley (it is reference style used in journals) and Zotero and sequence to support to accept video material and animation that develop your scientific research. He has worked in agriculture system fulfillment of statement are essential if the work involves chemical, procedure or equipment that have any unusual hazard inherent in their use if involves the use of creature or human subjects. In [2] The Changsun Shin the paper Suggests to Study the circuit diagram maximum power point and renewable energy Harvesting. It is the relational expression between voltage and current. It is the new method and efficient to find a maximum power point for obtaining renewable energy, and testifies and validating the circuit diagram. In [3] The Rushikesh Brose represented document it is quad-pixel based Reversible Hiding Data for High Embedding Capacity. In relation hiding data techniques are prime issues and embedding capacity. The schemes which operate on the group of disjoint pixel and demonstrate the reversible watermarking. Demonstrate the efficiency of the developed technique with comparative simulation to leading off-line numerical method. He has worked to detect the lung cancer, digital image forensic and classification of machine learning embedding capacity Estimation of Reversible Watermarking Schemes.[4] The paper presents a home automation system which is based on ESP8266 self-contained IC embedded, remote application microcontrollers, and ZigBee and relay boards to water plants. Raspberry pi is also embedded system circuit toward mechanical irrigation scheme to control the flow of motor. For soil testing is need for the agriculture is precious method in the field. Soil sample is measured through sensor may be used as application using GPS receivers. In[5] NikeshGondchawar, Prof.J.G.Rana,"IOT Based Smart Agriculture Research are provided many application like data mining, Big data ,etc multiple technologies are mentioned have to collect the information of the agriculture field of the soil data set and to estimate the yield of crops prediction in different technologies. This document is mainly contributes on online monitoring of agriculture field using Wi-Fi technology to check the parameters such as temperature and soil moisture. This paper present an smart irrigation system for farming using a device raspberry pi, for building the automation and make use of electricity and to reduce the water. The programming language python is purpose for automation.

VII. PROPOSED SYSTEM

In proposed system there is an efficient use of water for irrigation. Whenever is necessary feed the water to the plants, most of the farmers has been already used in irrigation system in form of water to the plants like bases of soil value of ph, humidity, temperature and light. The projected irrigation system drive is very efficient in areas like school garden, lawn etc. someplace watering plants is needed every day. This system also presents one of drip irrigation method to water plants using devices like are Atmega328 microcontrollers. An Atmega328 microcontroller is one of the Main controller units. Navigation, sprinkling and weed cutting activities are controlled from an android Mobile phone through Bluetooth communications used to control the system wirelessly. And also the farmer gets the status time to time.

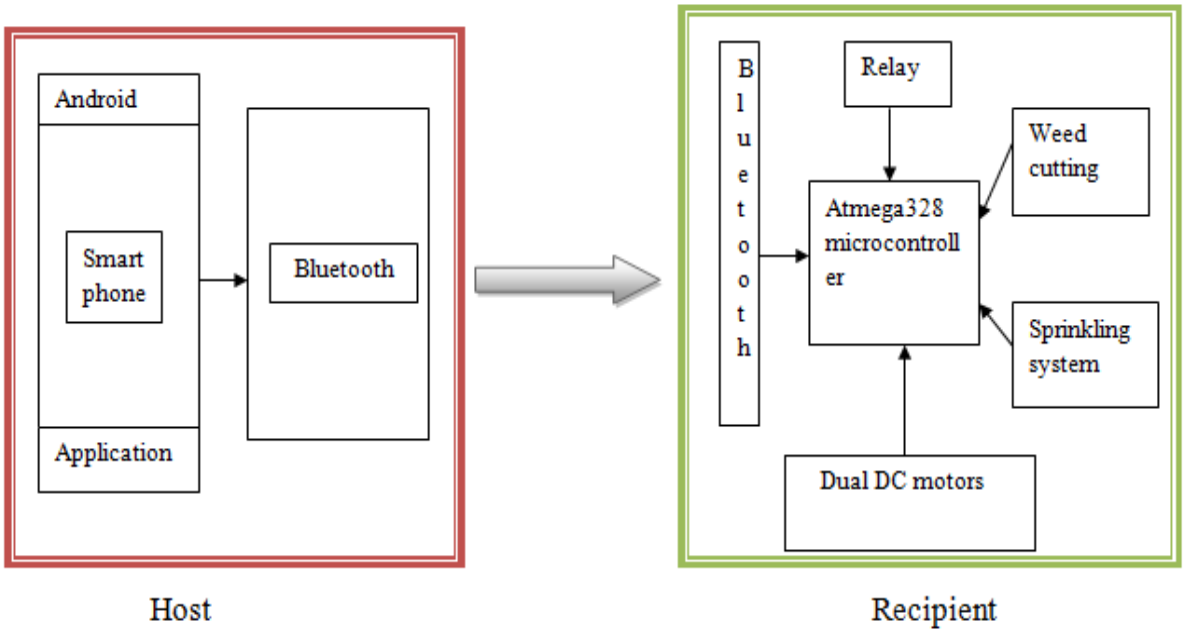

Fig.1. Host and recipient block diagram

VIII. ARCHITECTURE OF THE SYSTEM

4.1 SYSTEM ARCHITECTURE

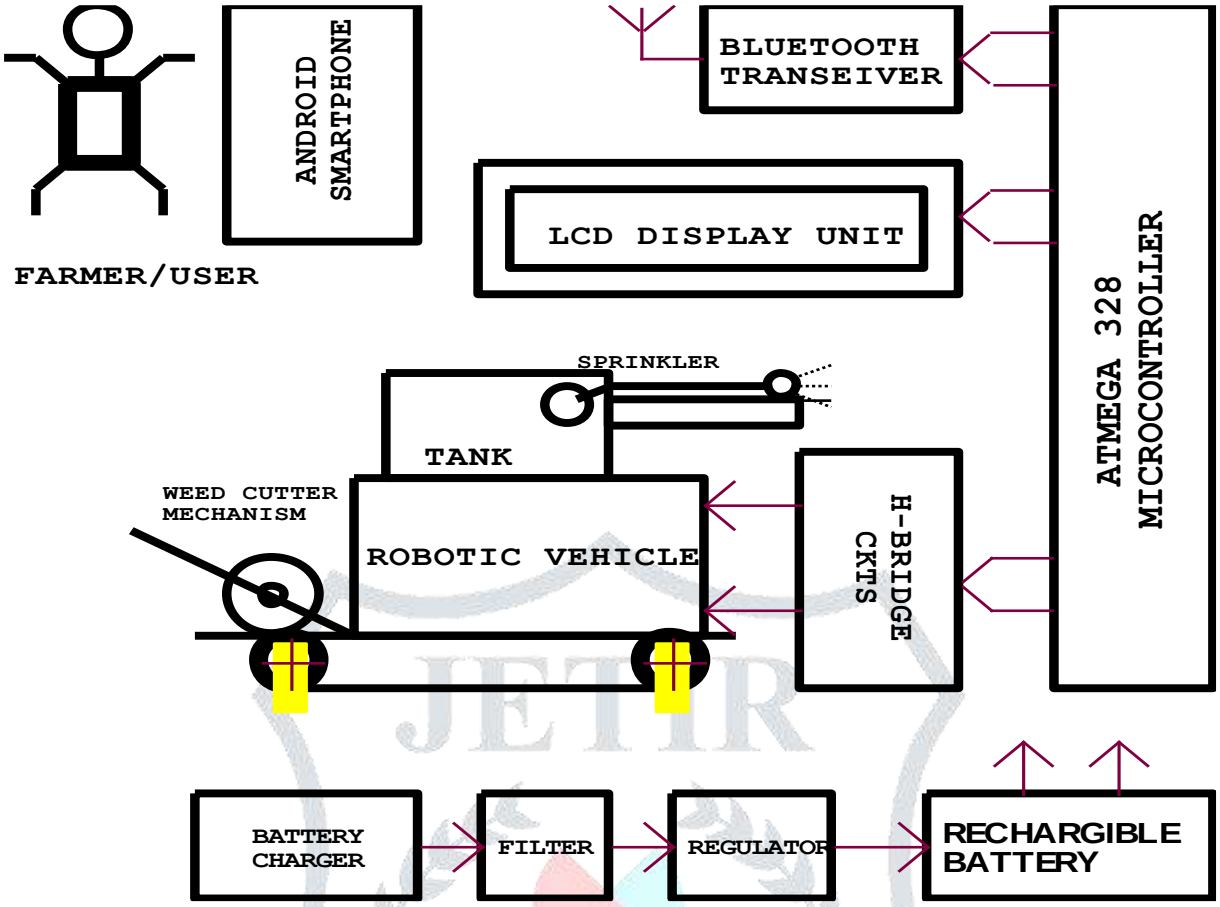

Fig.2. Development of a Bluetooth Wirelessly Controlled Agriculture Robotic Vehicle for Sprinkling and Weed Cutting Applications

1. **Android Smart Phone: -** An Android Smart phone is used number of people because it is long range wireless remote controller for navigation the vehicle and to sprinkle water and to move jet arm to required position through its Bluetooth capability. The purpose of this android application for smart travel guide is designed in this project. The Surveillance System is proposed for the Smart phone. An Atmega328 microcontroller will receive the command from the android application and triggered the robot accordingly.
2. **Arduino Uno: -** The Arduino Uno can be encoded using the Arduino software (IDE). Microcontroller has operating voltage is 5V. Particularly project has enough to store the data it contains 32KB of flash memory. The Arduino Uno act as the central controller for whole unit of the Robotic and it is encoded using Arduino software (IDE).
3. **Atmega328 Microcontroller: -**The Microcontroller is computational tools and computing machines were always most common implementing of ATmega328 is used platform developing Arduino Uno board. Another alternative with a low power of ATmega328 called ATmega328P is also used now which is a Pico power version. Microcontroller are devoted to one assignment and run one specific program
4. **Bluetooth HC-05 Module: -** It is Serial Port Profile, which can configure as Robotic for wireless connection transparent usage. This module has RS-232 format it receives the data serially from controller and sends it to wireless network. The HC-05 support two work mode: Command and Data mode. Bluetooth device using a set of AT command. Once configured as master, it can pair with module HC-05 allowing to do point to point serial communication.

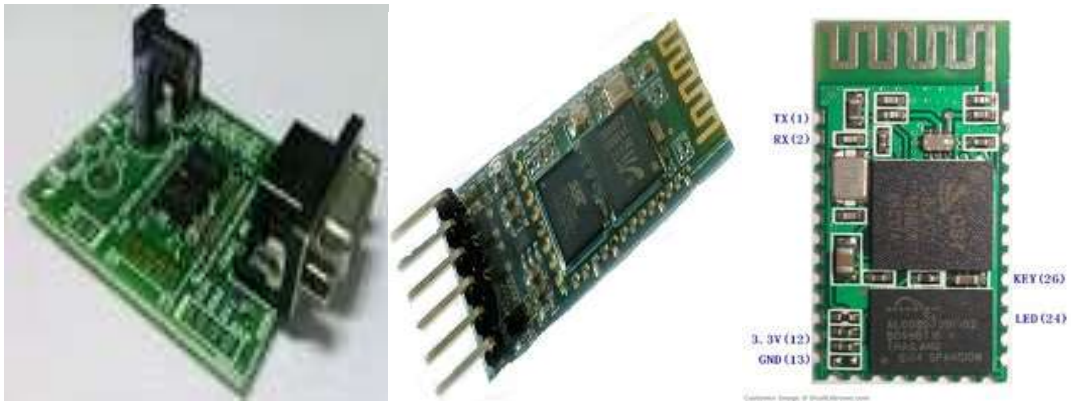

Fig.3. Bluetooth HC-05 Serial Communication Modules

5. **Geared DC Drive Motors: -** Motors are used to drive robotic vehicle in single required direction and to rotate the weed cutter blades. It has two magnets opposite polarity of an electric coil in the DC motors. The power supply is added to the coil to flow the current in the circuit and a small magnetic field generates.
6. **H-Bridge DC Motor Drive Circuit: -** This motor Circuit consists of an H-bridge IC driver circuit. These H-bridges internally have transistor pairs that can drive the motor in one direction if a pair of transistors is operated and operating the other pair drives the motor in opposite direction. IC L293D is used for this purpose. It often four switching elements within the bridge. For robotics it is used Dual H-Bridge Motor Driver IC L293D.

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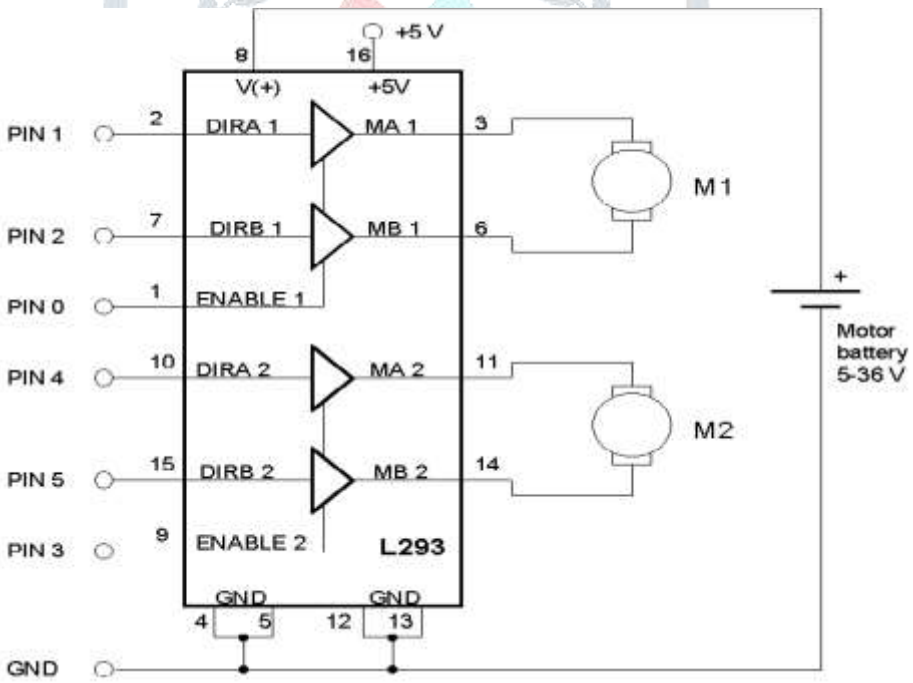

Fig.4. H-bridge Circuit for motor M1 and M2

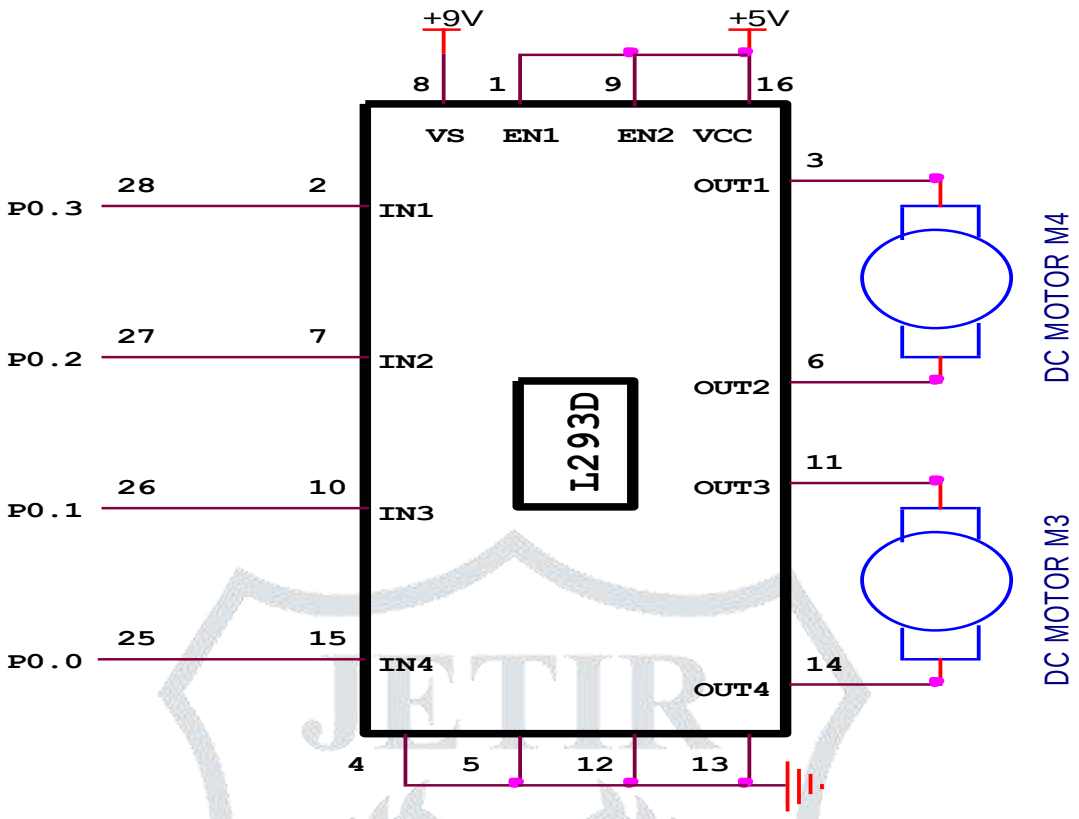

Fig.5. H-bridge circuit for motor M3 and M4

7. **Limit Sensor Switches: -** Since the operator is far away from the Fire fighter robotic vehicle and would give command wirelessly to rotate water jet mechanism beyond its extreme limit. If motors are allowed to move beyond limit would damage the entire mechanism of the system. Limit switches are used to inform microcontroller to stop motors when water jet mount is moved to its left or right extremes. These are lever type limit switches. Microcontroller checks the status of these switches before and during rotating any motor in any direction and stops rotation immediately, if limit is approached.
8. **Sprinkler System: -** The sprinkler is used to throw pressurized water or other liquid fire extinguisher solution at fire. A windshield washer pump is used as Liquid or water Sprinkler here it is mechanical. This attached with a nozzle, helps in pointing water stream into fire affected area.

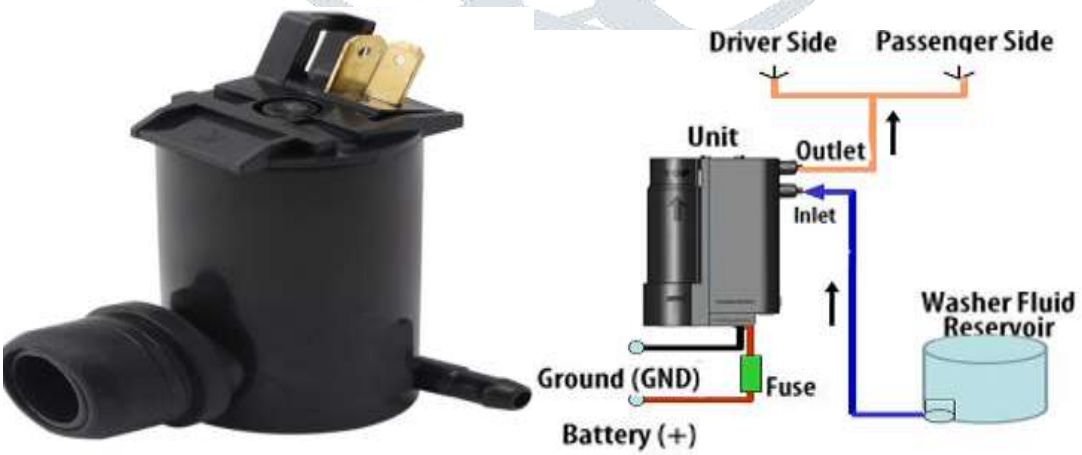

Fig.6. Sprinkling System

9. **Relays and Relay Driver Circuits: -** Relay is an electrically operated switch most widely used when power off or current switch off and the links to open yet again, switch the device. It is oldest and useful property of relay for completely separate, coils powering switch circuit. It has Switches opening and closing circuit of the relays done

through electromechanically or electronically and it has controlling capacity in other circuit. The relay power required for robotic it will handle power drive motors

10. **Transformer: -** It is type step-down transformer is used to reduce the voltages to the low voltage. It is used on devices which transform the 230 volts 50Hz, it is required small voltage but AC electrical power to the other circuit and maintains the constant frequency and alters the increased and decreased voltage level according to the requirement. Ordinary transformer silicon steel core is used 1A current rating. The Primary Transformer is connected to main AC through switch ON/OFF or fuse. Transformer help to the operator is to avoid the electrical shock i.e. isolated from mains. Our design uses full wave bridge rectifier with the center-trapped transformer, to obtain dual-tracking voltages i.e. +Ve and –Ve voltages with respect to ground. At-least 15VA power output rated in transformer.
11. **Weed Cutter Mechanism: -** Weed cutter blades are fitted below robot for cutting unwanted grass in crop. It consists of a blade fitted to another geared DC motor. This geared DC motor is controlled through a transistor NPN in a CE Configuration. It supplies current to the geared DC motor, connected in its collector's circuit. The TTL level signal is used in microcontroller to send signal logic'1' is used as turn on motor to rotate and a logic'0' is used as turn off. . Thus, the microcontroller can control there weed cutter geared DC motor by sending TTL level signals.

Fig.7. Weed Cutter Mechanism

12. **Power Supply Section: -** The sections of the power supply have to provide regulated D.C it supplies to all other system section. This system typically consists of a storage battery and charger circuitry for providing power to the entire system. The storage element is a battery providing the peak current and acting as the main reservoir. There are many battery of technology but we have chosen Lithium Ion and less important smart phone for our storage element. The battery Li-Ion have brilliant energy storage capacity, charge/discharge long lifetime characteristics, internal resistance is low, and self discharge exhibit very little. When the switch is kept to CHRG position, the circuit derives power from AC mains, rectifies it is convert to DC and filters it to make it smooth DC and feeds to the rechargeable battery. The battery gets charged to 12V DC. When the switch position is changed to ON, the battery supplies 12V DC to the circuit and start functioning on the system. The 7805 regulator converts this 12V DC into +5V regulated DC and provides it into all circuits which work on 5V. Charger circuit is built using Step-down Transformer, Rectifier diodes, Filter capacitor and voltage regulators.

4.2 SYSTEM PERSPECTIVE

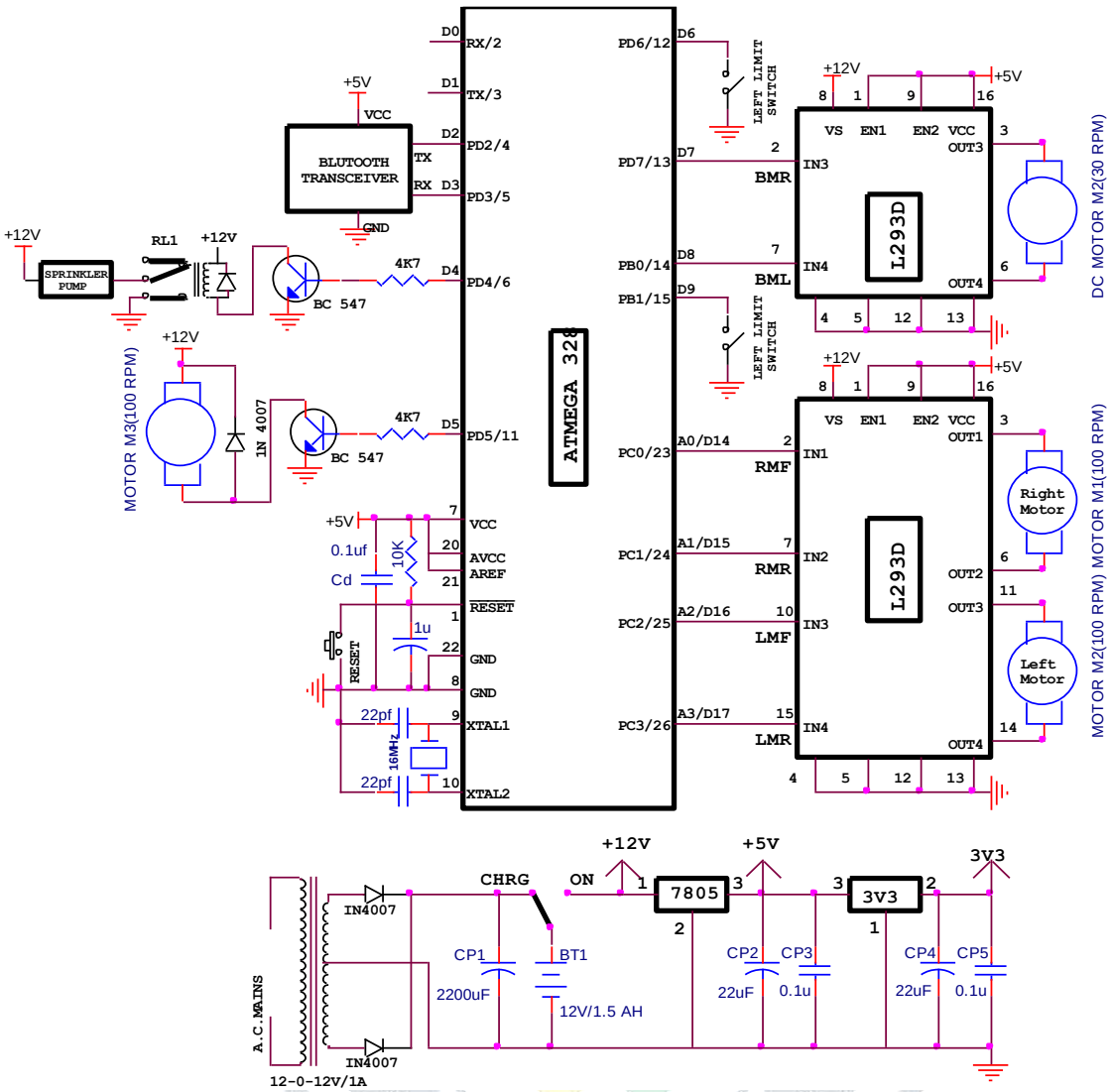

Fig.8. Circuit diagram of navigation control unit

The complete Robotic **Vehicle Unit** is shown in the figure 6. This unit is mounted on the robotic vehicle. It consists of two sub units as shown in figure. The navigation control unit takes care of communication with user's Smartphone through Bluetooth for controlling the movement of motors of base and sprinkler and also weed cutter. As shown, the combined unit contains two Atmega328 Microcontrollers, HC-05 Bluetooth Transceiver Module, H-Bridge Motor Drive Circuits, Extreme Limit Sensing Lever Switches, Water Tank, Sprinkler Pump and its Driver Circuits.

This system is designed to operate on rechargeable batteries, to make it totally free of any wires (to the AC mains) for the freedom of moment. The battery is charged by AC supply through charger circuit. The charger circuit consists of Step-down Transformer, Rectifier diodes, Filter capacitor. When the toggle switch is kept towards "RECHARGE", the batteries get connected to the charger and disconnected from the entire microcontroller side circuitry and only charging is taking place. The battery supplies 12V DC to the circuit and the system starts to function. The 7805 regulator converts this 12V DC into +5V regulated DC and provides it into all circuits which work on 5V.

The Atmega328 microcontroller is working as a small embedded computer which performs all the control functions of the system to stored its internal flash memory by + executing the program. When power supply and clock (by external crystal) is provided, the microcontroller starts executing program from its internal flash program memory and controls the activities of all the sub-sections of the system.

IX. EXPERIMENTAL RESULTS

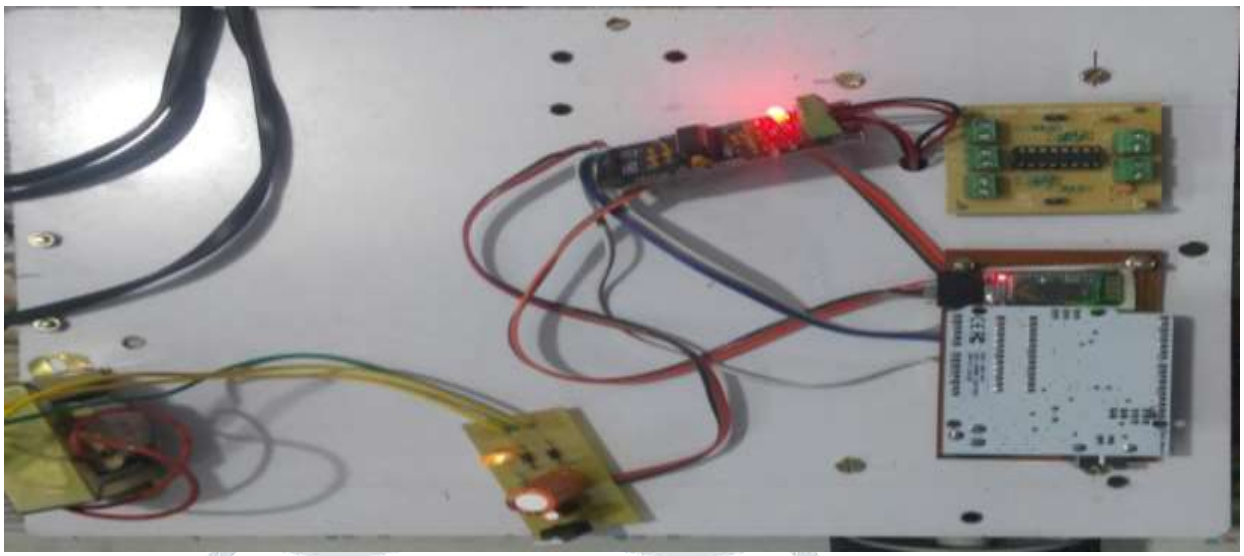

Fig.9. Initial Connection of Bluetooth Module

Fig.10. Complete Structure of Sprinkling and Weed cutting Module

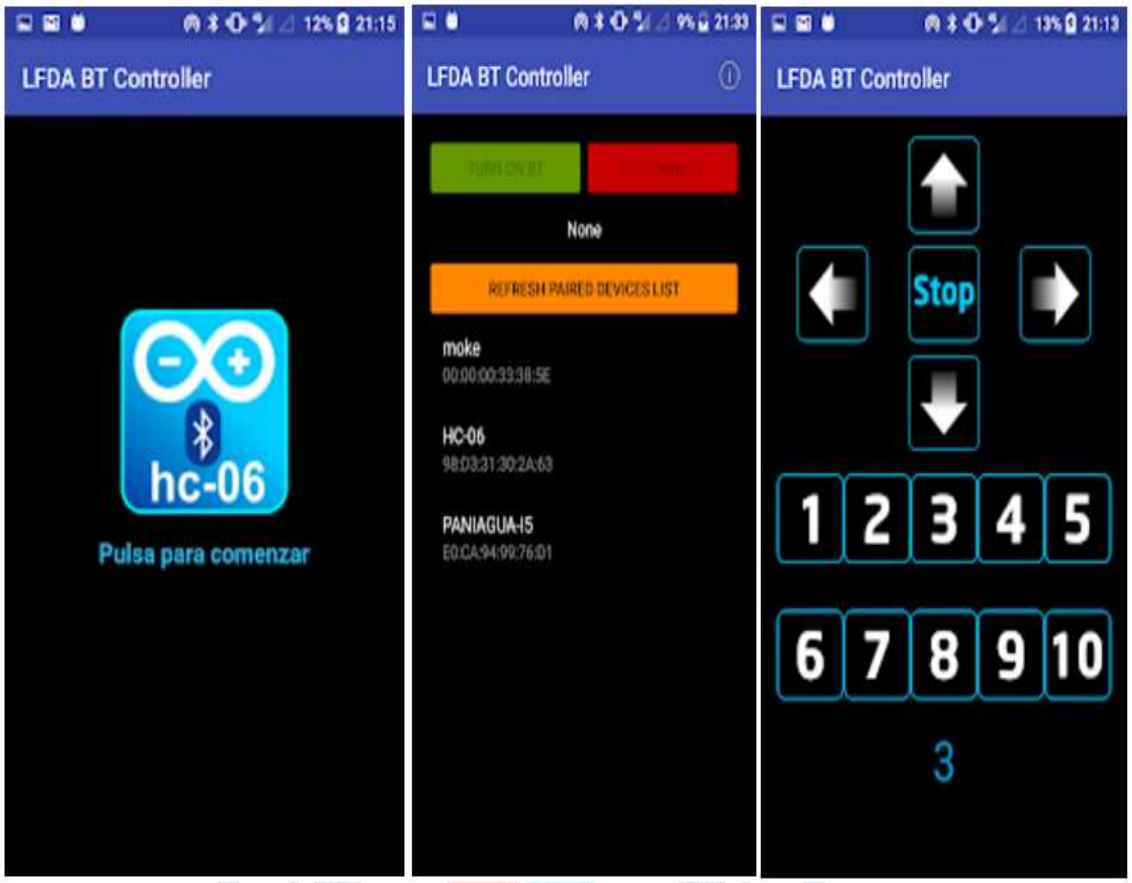

Fig.11. Operations of Robotic User Manual

This work is to describe the project design and fabrication of working prototype of **An Advance IOT Based Multi Activity Agriculture Robotic Platform with Android Controlled Navigation.** We have implemented innovative robotic vehicle and also android application is designed for controlling vehicle remotely it will help for Android Bluetooth feature. The Robot is controlled using Atmega328 microcontroller which is considered the brain of this robotic system. The design was inspired from the car design where 2 wheels are used in the robot. Thus the prototype of this vehicle is designed and it is also working properly. It successfully does it the intended operations like navigation and sprinkling with the help of sprinkler jet. The Sprinkler Switch on/off enable in the system is obtained the value from sensors. The process of monitoring irrigation in the field has to monitor and control the activities of the robotic vehicle. So to help the farmer is making smart farming. The prototype has expected as it is functioned and the result desired to produce. This model system has performed reliably and the scaled-up model can be used for real forming applications.

X. CONCLUSION

Project aim was to support technology innovation to attain a reliable and efficient outcome. The movement of the robot is controlled by the smart phone and the microcontroller based system which is fixed on the mobile platform. The conclusions drawing from this paper are as follows. 1) This project introduces wireless technology in the field of agriculture. 2) Exploits features of Android platform to help Farmers Significantly. 3) Provides a flexible user interface to farmer to control the machine effectively. 4) It reduces manual labor requirement which is a boon to the farmers as finding laborers is a very difficult job today. 5) The time required to carry out the five functionalities reduces considerably in comparison with carrying out the same activities manually. 6) It is a onetime investment which reduces the overall farming cost considerably. 6) This Agriculture robot acts as a gateway to automated smart farming.

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